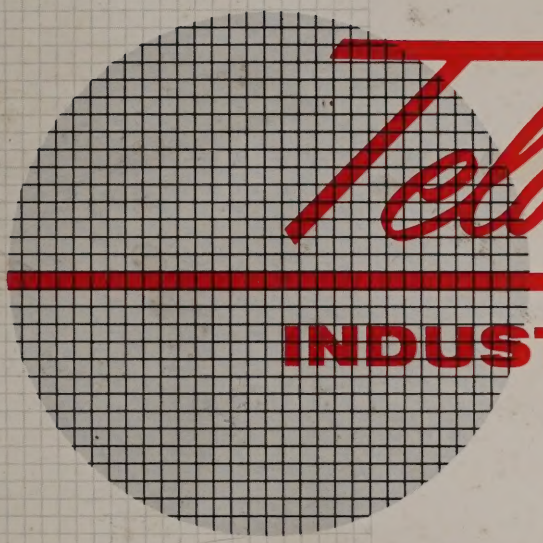
# INSTRUCTION MANUAL



Telonic

INDUSTRIES, INC

**MODEL** LD-5M

SERIAL NO. 6935

SWEEP GENERATOR

**MODEL** LD-5M

SERIAL NO. 6935

SWEEP GENERATOR

Telonic INDUSTRIES, INC. BEECH GROVE, INDIANA

# WARRANTY

## TELONIC INSTRUMENTS AND ACCESSORIES

Products manufactured by TELONIC INDUSTRIES, INC. are guaranteed against defective materials and workmanship for a period of one year (vacuum tubes and semiconductors excepted) from date of purchase. This warranty does not apply to instruments that have been altered, improperly handled or damaged in any way beyond our control.

Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

## CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications, without incurring any liability to modify equipment previously sold.

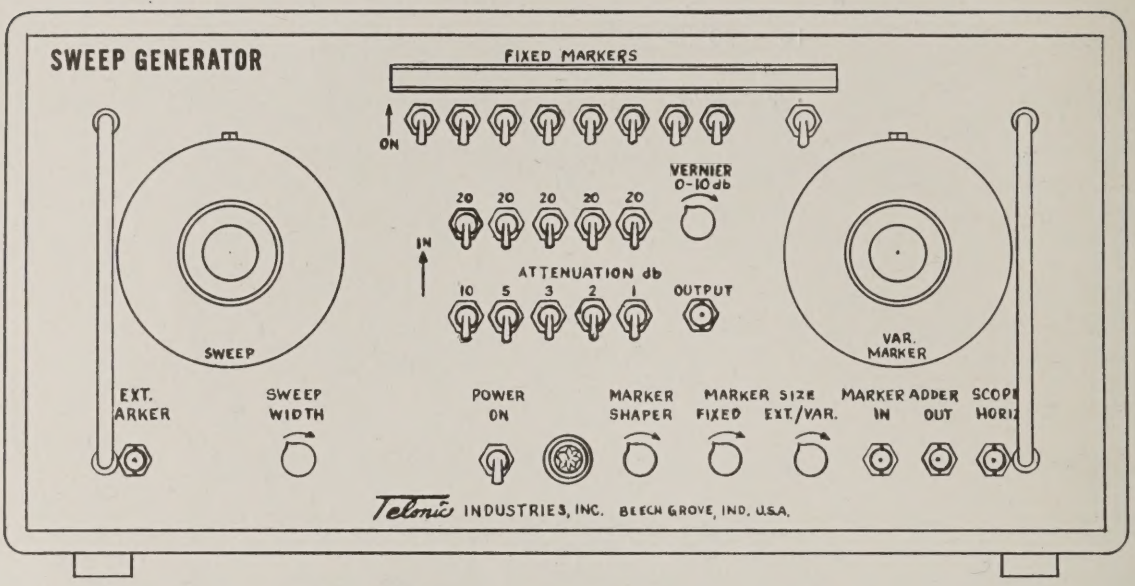
## RETURNING EQUIPMENT TO FACTORY

Factory service is available for repair and readjustment of this instrument. However, a description of the trouble should be forwarded FIRST, whereupon instructions for correcting the trouble OR authorization for returning the equipment will be given. This applies to all units, whether under warranty or not.

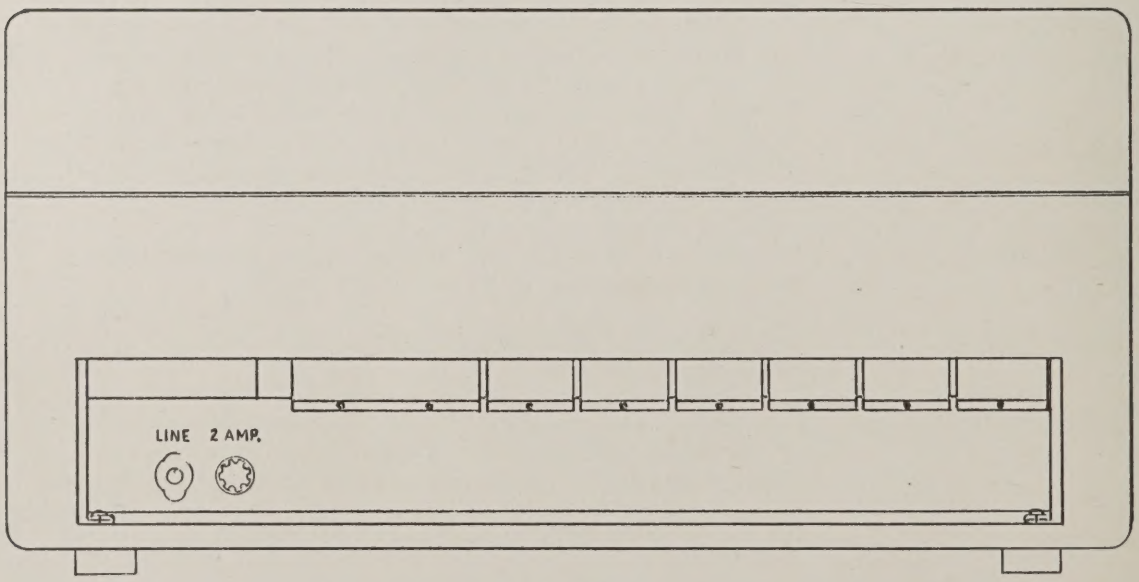
# SPECIFICATIONS

## MODEL LD- 5 M SWEEP GENERATOR

| | |
|---|---|
| CENTER FREQUENCY | 20 - 75 MC |
| FREQUENCY RANGE | 16 - 90 MC |
| SWEEP WIDTH | .05 - 40% |
| OUTPUT | |
| Voltage | 1 volt RMS. |
| Impedance | 50 ohms. |
| Flatness | 5% over maximum sweep width. |
| ATTENUATION | |
| Toggle Switch | 20,20,20,20,20,10,5,3,2,1 db. |
| Vernier | 0 to over 10 db. |
| DISPLAY LINEARITY | Normally below 1.2:1. |
| RADIATION | Less than 1 microvolt. |
| SWEEP RATE | Line Frequency (50-60 cps.) |
| ZERO BASE LINE | Oscillator off 50% of the time during return sweep. |
| SCOPE HORIZONTAL SWEEP | Approximately 25 volts peak to peak. |
| SOURCE VSWR | Normally below 1.2:1. |
| POWER | 115 v. 50/60 cps. Approximately 100 watts. |
| MARKER SYSTEM | |
| Birdy-By-Pass Marker Circuitry | The outputs of the marker oscillators and the external marker signal are mixed with a sample of the sweep oscillator signal to produce beatnotes or birdies. These birdies are amplified and superimposed upon the detected RF output signal before it is applied to the vertical scope input. Amplitude and width of the markers are adjustable over a wide range. |
| External Marker Input | An external CW signal of approximately 0.1 volts may be used to produce a "birdy" type marker. |
| Variable Marker | Calibrated variable marker over entire range. Accuracy - .25%. |
| Plug-In Crystal Markers | Provisions are included for up to eight single frequency or harmonic type plug-in crystal-controlled markers. These markers are optional and may be included in this instrument or added at a later date. See our literature for further details regarding these markers. |
| PHYSICAL DESCRIPTION | Panel Size - 1/8" x 8 3/4" x 19". Chassis Size - 2" x 14 1/2" x 17". |




FRONT




REAR

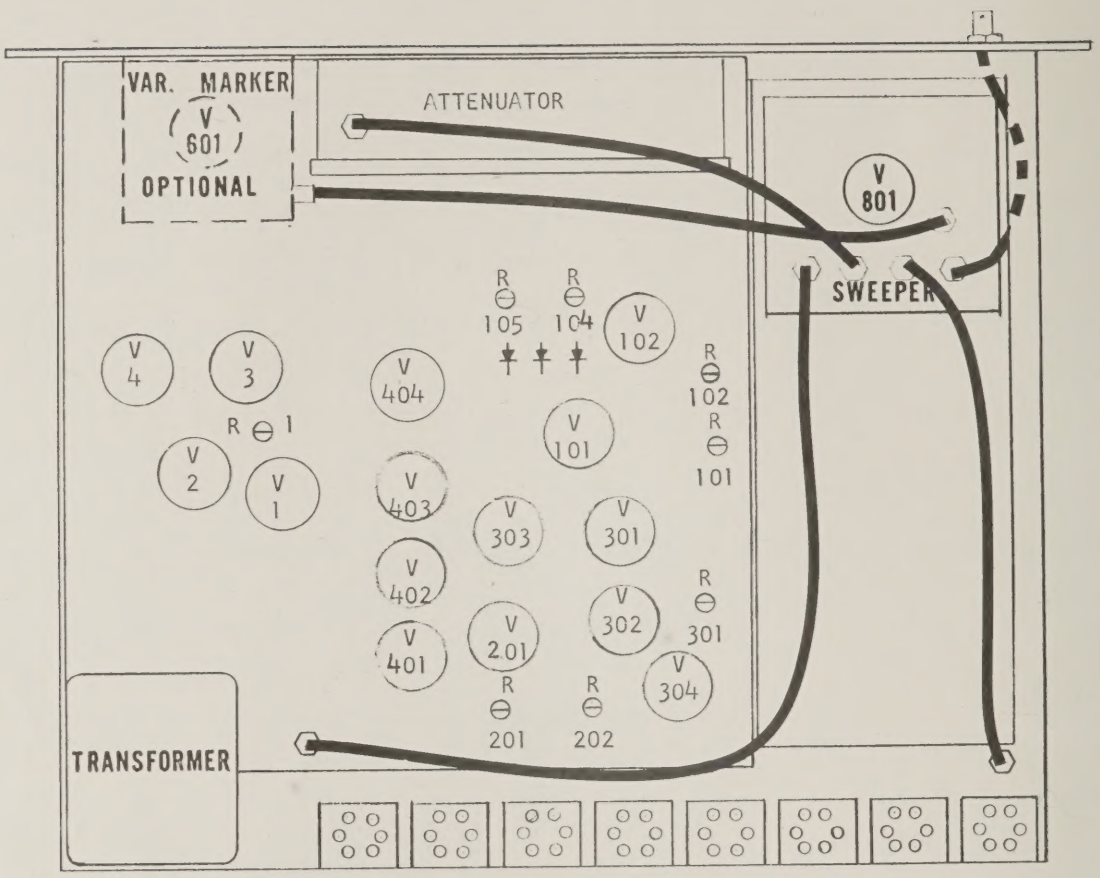


10

# DESCRIPTION OF FRONT PANEL

| | |
|---|---|
| SWEEP DIAL | Indicates Center frequency of the sweep oscillator at minimum sweep width. |
| VERNIER ATTENUATION | Provides 0-10 db. of vernier attenuation. |
| TOGGLE SWITCH ATTENUATOR | Provides the indicated amounts of step attenuation. |
| OUTPUT | RF Sweep Output - BNC Connector - Impedance 50 ohms. |
| EXTERNAL MARKER | Marker input for external signal source. |
| SWEEP WIDTH | Varies the amount of drive current supplied to the saturable reactor and can be used to vary the sweep width. |
| POWER ON | Switches AC power on and off. |
| MARKER SHAPER | Varies the width of the marker signals. |
| MARKER SIZE | |
| Fixed | Varies the amplitude of the fixed markers (crystal plug-in units). |
| Ext/Var | Varies the amplitude of the external and variable marker signals. |
| MARKER ADDER | |
| In | The demodulated signal from the device being tested is fed into this connector so that marker signals may be superimposed. |
| Out | This connector should be connected to the vertical input terminals of the scope for viewing the demodulated signal and markers. |
| SCOPE HORIZONTAL | This connector should be connected to the scope horizontal amplifier input. |
| FIXED MARKERS | These switches supply B+ to the fixed markers (crystal plug-in units) when in the "On" Position. |
| VARIABLE MARKER (Optional) | |
| Dial | Calibrated dial indicates the frequency of the marker. |
| Switch | Supplies B+ to the variable marker when in the "On" Position. |

# CHASSIS LAYOUT

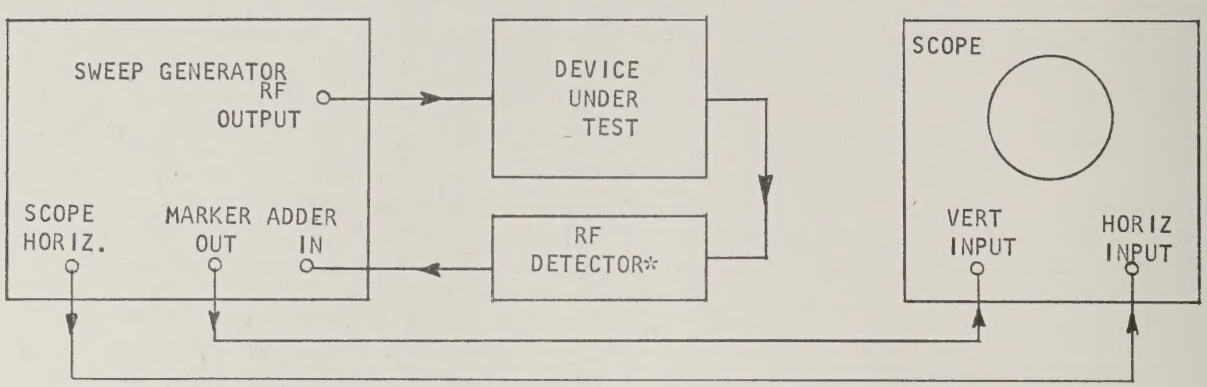



| | |
|---|---|
| V1 | 5651 |
| V2 | 6AU6 |
| V3 | EL84/6BQ5 |
| V4 | EL84/6BQ5 |
| V101 | 12AX7 |
| V102 | EL84/6BQ5 |
| V201 | 12AX7 |
| V301 | 6AU6 |
| V302 | 12AX7 |
| V303 | 6AU6 |
| V304 | EL84/6BQ5 |
| V401 | 12AX7 |
| V402 | 12AX7 |
| V403 | 12AX7 |
| V404 | 12AX7 |
| V601 | 12AV7 (optional) |
| V801 | 12AV7 |

# DESCRIPTION OF CHASSIS CONTROLS

| | |
|---|---|
| R1 - B+2 ADJUST | This control varies the bias on the amplifier, V2, for the B+ regulator, V3, and is adjusted to produce a regulated B+ voltage (B+2) of 175 volts. |
| R201 - BLANKING PHASE | This control adjusts the phase of the Blanking Pulse with reference to the phase of the Horizontal Sweep Voltage and the Sweep Oscillator. |
| 202 - BLANKING WIDTH | This control is the grid resistor for the Blanking Pulse Generator, V201. It is adjusted to blank one-half of the sweep cycle to produce a zero base line. |
| R101 - SWEEP WIDTH LIMIT | This potentiometer controls a voltage supplied to the front panel sweep width control and is used to adjust the sweep width when the front control is set at maximum. |
| R102 - CENTERING | Controls the average current through the saturable reactor which in turn controls the center frequency of the Sweep Oscillator. |
| R105 - LINEARITY | Adjusts the Display Linearity of the high frequency side. |
| R104 - LINEARITY | Adjusts the Display Linearity of the low frequency side. |
| R301 - LEVEL MAXIMUM | This control adjusts the average B+ voltage supplied to the Sweep Oscillator and is used to adjust the maximum RF Output to a value as shown on the specification sheet. |

# OPERATING INSTRUCTION




TYPICAL SET UP - The following procedure is recommended for setting up this instrument in test position.

1. Connect unit to proper power line voltage and turn POWER ON switch to ON position.

2. Make connections to the scope, the device under test, and RF Detector as shown above. All connectors located on the sweep generator are BNC type and it is recommended that RG cable be used for all connections. This insures good ground connection between each device, minimizes hum, leakage from unit and pick up of spurious external signals. The cable that is used to connect the RF OUTPUT to the device under test should match the impedance of the sweep generator. If the input impedance of the device under test is different than the impedance of the sweep generator, a matching network should be used to insure a constant input signal.

3. Adjust the RF output level by means of the OUTPUT LEVEL or VERNIER ATTENUATOR control and the step RF ATTENUATOR to the proper input signal for the device being tested. Failure to do this will result in incorrect reading on the scope.

4. Adjust the SWEEP WIDTH control and center frequency SWEEP DIAL to cover the desired frequency range.

5. MARKERS
   Markers may be produced by one or more of the following methods depending on the specific unit.
   A. Plug-in crystal markers (C type).
   B. Plug-in crystal harmonic markers (CDH or CH type).
   C. Internal variable marker.
   D. External C.W. Signal.
   First turn on marker unit or inject external C.W. signal and adjust MARKER SIZE and SHAPER until markers are of a convenient size and width.

*See Telonic literature for detector recommended for use with this instrument.

# INTERNAL CONTROL ADJUSTMENT

THE INTERNAL CONTROLS are adjusted at the factory and normally do not require any readjustment, however, should it be desirable to check these adjustments, follow these Steps:

1 - Connect the unit as shown under operating instructions but omit the device under test. The recommended detector for this unit is the Telonic XD-8 for units with 50 ohm RF output impedance and the Telonic XD-9 for units with 75 ohm RF output impedance. Turn unit on.

2 - B+2 ADJUSTMENT: Adjust R1 to provide a regulated B+ voltage of 175 volts (blue wire).

3 - BLANKING PHASE and WIDTH ADJUSTMENT: Adjust the BLANKING PHASE control, R201, and the BLANKING WIDTH control, R202, to produce a rectangular pattern on the scope.

4 - RF OUTPUT LEVEL ADJUSTMENT: Adjust LEVEL MAXIMUM CONTROL, R301. until the vertical height of the pattern equals the peak to peak RF voltage shown on the specification sheet, Page 1. Since the RF Detector is approximately 90% efficient, the actual RF output voltage will be slightly higher than the voltage shown on the scope.

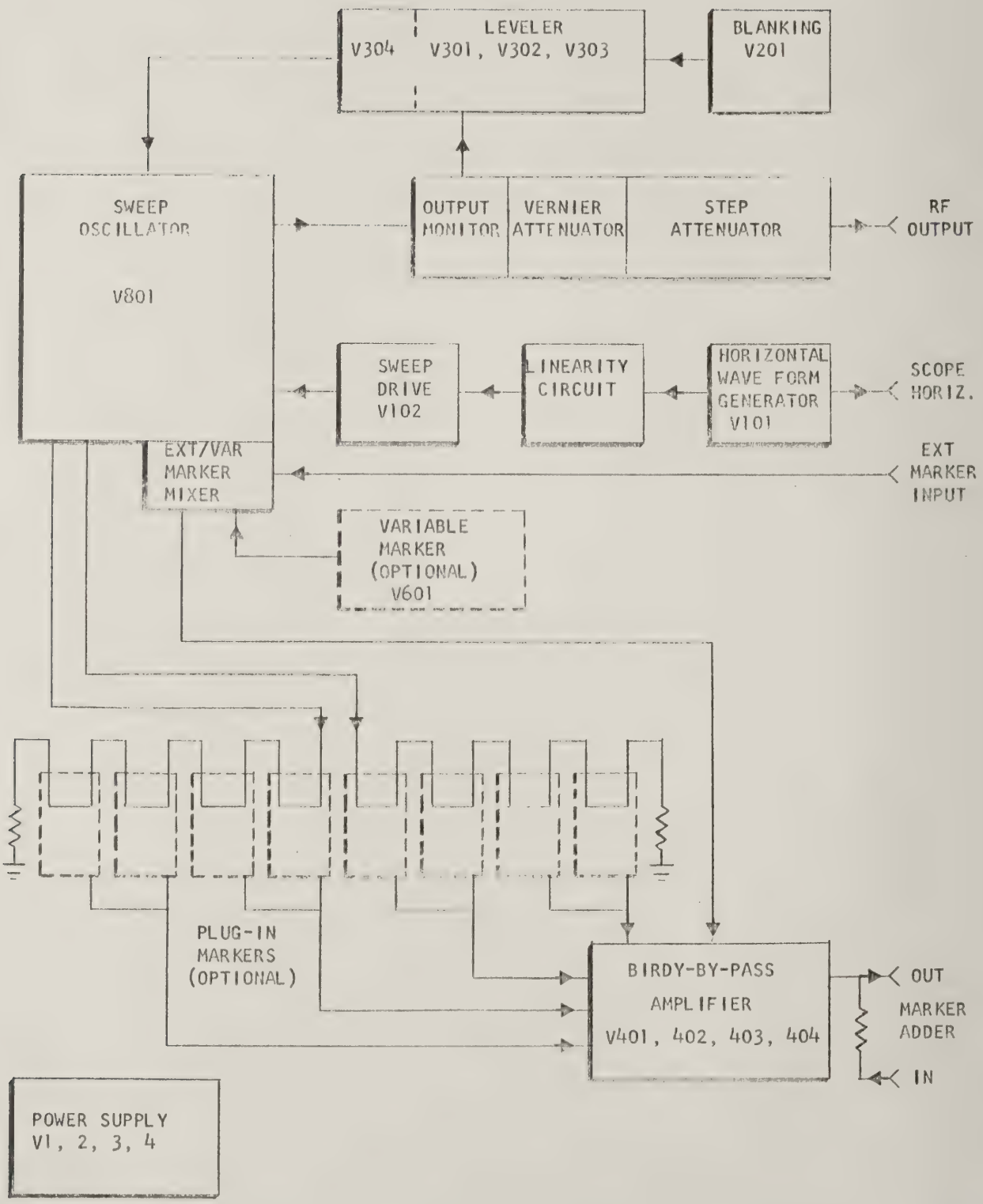
MARKERS MUST BE PROVIDED FOR THE FOLLOWING ADJUSTMENTS

5 - CENTERING ADJUSTMENT: This adjustment can be made indirectly by checking the accuracy of the sweep dial calibration. Set the sweep dial to its mid frequency position and the sweep width control to minimum. The centering control R102 can now be adjusted to correct any inaccuracy in the dial calibration.

6 - SWEEP WIDTH ADJUSTMENT: With the SWEEP WIDTH control on the Front Panel in its maximum clockwise position, adjust the SWEEP WIDTH LIMIT, to provide the maximum sweep width as shown on the specification sheet, Page 1.

7 - Linearity may best be adjusted when a number of markers are present on the display. In the factory, a 1 MC harmonic generator is used for this purpose. The LINEARITY controls are adjusted for equal spacing between the 1.0 MC marker points. This adjustment is to be made at maximum sweep width. Control R105 is used to adjust the high frequency side of the display and Control R104 the low frequency side. Since these adjustments affect the sweep width, it may be necessary to repeat step No. 6.

# BLOCK DIAGRAM



SWEEP OSCILLATOR: The sweep oscillator is a fundamental frequency type and uses a saturable reactor to obtain the sweep. This sweep voltage is adjusted to the desired center frequency by varying the oscillator tank capacity with the Front Panel Sweep Dial.

SATURABLE REACTOR: The saturable reactor consists of a signal winding and a control winding. The inductance of the signal winding is varied at a 60 cycle rate by the control winding current. This varying current is supplied by the sweep drive tube V102. The average current through this tube is adjusted by varying the bias on the grid by means of the CENTERING Control. This current will partially saturate the signal winding and set the operating point of the saturable reactor so that as the current is varied above and below this value, the inductance of the signal winding will also vary linearally above and below its partially saturated value.

LINEARITY CIRCUIT: Saturable reactors exhibit some nonlinearity when operating at maximum sweep width. As the current increases in the control winding and the reactor begins to saturate, the inductance change for a given current change becomes smaller. To correct this, the 60 cycle sawtooth drive voltage applied to the grid of the sweep drive tube is shaped by the linearity circuit which consists of 3 diodes and a biasing network for the diodes. The effect of this circuit is to cause the current in the control circuit to change at a faster rate as the reactor approaches saturation, thus counteracting the slower inductance change.

HORIZONTAL SWEEP AND SATURABLE REACTOR DRIVE VOLTAGE: The sawtooth voltage for the scope horizontal sweep and the saturable reactor drive tube is produced by V101. A 6.3 volt sine wave is applied to the grid of one of the triode sections of V101. The tube then clips and amplifies the grid signal so that a square wave is produced at the plate. This square wave is then integrated by an RC network in the plate circuit to produce the sawtooth voltage. This sawtooth voltage is then applied to the second triode section of V101, which is connected as a cathode follower and produces the same sawtooth voltage. This voltage is then applied to the horizontal output connector on the Front Panel and to the linearity circuit.

BLANKING CIRCUIT: The purpose of the blanking circuit is to produce a zero base line by removing B+ from the sweep oscillator during the sweep retrace. The blanking voltage is originated by a square wave producing circuit. A phased 6.3 volt sine wave is squared and amplified by the blanking tube. This square wave output of V201 controls V304 (EL84), the sweep oscillator voltage regulator tube, and thus deprives the sweep oscillator of voltage during one-half of each cycle. PHASE and WIDTH Controls are provided for adjusting this blanking voltage to coincide with the horizontal and sweep drive signals.

AUTOMATIC OUTPUT LEVELING CIRCUITRY: The sweep oscillator output is detected by the monitor, amplified in a D.C. amplifier, and used to control the plate voltage of the sweep oscillator. The LEVEL Control adjusts the bias on the first stage of the amplifier. This causes the DC levels in the entire amplifier to change, and varies the average B+ supplied to the sweep oscillator from a minimum of 25V to over 100V. A small decrease in the monitor voltage causes a large increase in the B+ supplied to the RF oscillators, and thus counteracts any amplitude variation. The operation of this circuit and of the sweep oscillator can be checked at the feed-thru

capacitor on the end of the Attenuator Box or Pin 1 of V301. The waveform at this point will normally show a flat output level over the entire band. Adjusting the LEVEL Control will change this level.

The monitor circuit consists of two (2) diodes in a full wave voltage doubler circuit. The use of the full wave detector prevents erroneous leveling information from occurring due to harmonic content and also provides a higher sampling voltage to control the leveling amplifier. The crystal diodes are mounted in such a way as to produce a negative output which is equal to about 75% of the peak to peak RF voltage.

POWER SUPPLY: The power transformer output of 140 volts AC is fed into a half wave voltage doubler, using silicon rectifying elements CR1 and CR2. B+ is taken off the capacity input filter to provide +375 volts unregulated to the plates of V3, (B+ Regulator Pass Tube), V304 (Oscillator Pass Tube), and V4 (Marker B+ Pass Tube).

B+2 is the output of the electronic regulator circuit, consisting of V2 and V3, and provides +175 volts regulated. Potentiometer R1 controls the operating point of V2, regulator amplifier, and is set for proper B+2 output voltage.

B+3 is obtained by biasing the grid of V4 at approximately 85 volts positive, which causes current to flow through cathode resistor R20. The voltage at Pin 3, V4, is supplied to the Plug-In Markers and maintains its regulation due to the low impedance characteristics of the cathode follower circuit and provides approximately 100 volts.

The B- voltage is obtained by the half wave Silicon rectifier CR3. Regulator tube V1 maintains this voltage at -82 volts, and supplies bias voltage to the leveler circuit as well as a reference voltage for the electronic regulator.

Resistor R4 acts as a fuse, protecting the transformer and rectifiers from overload.

The primary of the power transformer is normally wired for 115 volt AC line operation. However, it can be converted to operate from a 230 volt AC source if desired. This conversion is described in the Maintenance Section.

# MARKER SYSTEM DESCRIPTION

## GENERAL

A sample of the sweep signal is mixed with the fundamental or a harmonic of the crystal plug-in marker units, variable marker, or external signal to produce beat notes or birdies. These birdies are then amplified and superimposed upon the demodulated swept signal and applied to the vertical amplifier of the oscilloscope. The size and shape of the marker may be varied over a wide range by the size and shaper controls of the birdy amplifier.

## VARIABLE MARKER

The variable marker oscillator uses a twin triode in a balanced, push-pull oscillator arrangement using cross-coupled plate to grid feedback. The frequency of this oscillator is controlled by varying the oscillator tank capacity with the front panel frequency dial.

The output from the variable marker oscillator is then fed into a crystal diode mixer where it is mixed with a sample of the sweep oscillator signal. The resultant birdy is then fed into the birdy-by-pass amplifier.

## EXTERNAL MARKER INPUT

The CW signal from the external marker input is fed into the same mixer as the variable marker, where it is mixed with a sample of the sweep signal. The resultant birdy is then fed into the birdy-by-pass amplifier.

## PLUG-IN-MARKERS

This unit has provisions for a maximum of eight single frequency type crystal marker units, or four harmonic type crystal markers, or any combination. Each harmonic marker occupies the space of two single frequency markers.

Two sweep sample outputs are available from the sweep oscillator, in order to minimize coupling between markers signals. Harmonic and single frequency markers should not be fed from the same sweep sample line.

## SINGLE FREQUENCY MARKERS ("C" TYPE)

These crystal markers are self-contained plug-in units. Additional units at other frequencies (within the range of the sweep generator) may be ordered and substituted for the orignal units.

The crystal oscillator units include the tube, crystal, oscillator tuning, crystal diode mixer and a tuned circuit selecting the sweep input frequency. A test point is provided for easy adjustment of the overtone crystal oscillator (this circuit used above 12 mc). In making this adjustment, the crystal oscillator coil slug is adjusted for near maximum voltage at the test point. This is usually in the order of 2-5 volts as measured with a VTVM. The adjustment should be made just slightly off the peak on the low inductance side, since the effects of tuning are critical on the other side of the resonance curve. Crystal oscillators below 12 mc. are Pierce type oscillator circuits which require no tuning.

By tuning the sweep sample coil, the frequency of the sweep input signal can be varied and thus minimize unwanted markers generated from other harmonics of the crystal oscillator. The amplitude can be varied by adjusting the coupling.

HARMONIC MARKERS (CDH TYPE)

Harmonics of a crystal controlled oscillator are amplified and mixed with a portion of the sweep signal to produce a uniform display of markers at regular intervals across the sweep range. Markers will appear at intervals determined by the crystal frequency. A frequency of 5 mc. is used on models to approximately 500 mc. and 10 mc. on models above 500 mc. Crystal accuracy is $\pm$.005%.

POWER SUPPLY: Since a defect in the power supply will affect all circuits, it should be checked for proper operation before proceeding to other circuits.

| SUPPLY | NOMINAL VALUE | NORMAL VARIATION | NORMAL RIPPLE | WIRE COLOR* |
|---|---|---|---|---|
| AC Line | 115V | --------- | ------ | ------ |
| B+1 | 375 | ±15 volts | 6 to 15 volts | Red |
| B+2 | 175 | ±.5 volts | 12 to 25 millivolts | Blue |
| B+3 | 100 | +5-10 volts | 15 millivolts to .5 volts | Orange |
| B- | -82 | ±2 volts | 100 millivolts | White |
| 6.3 "A" | 6.3V AC | Main filament supply | | Heavy Duty Green |
| 6.3 "B" | 6.3V AC | 180° out of phase with supply "A". Source of phasing and filament voltages. | | Heavy Duty Gray |
| 6.3 "C" | 6.3V AC | Isolated filament voltage for tubes with cathodes above ground. | | Heavy Duty Brown |

Next: If power supply is operating normal, use the block diagram to isolate the trouble to a major section. Check tubes, diodes, and adjustment of Front Panel and printed wiring board controls located within that section (see Page 7 for adjustment procedure). By the use of the schematic, ordinary difficulties encountered can be readily located and remedied. The following trouble-shooting chart is an additional aid to servicing:

| SYMPTOM | POSSIBLE CAUSE AND REMEDIES |
|---|---|
| Pilot Light Off and Unit Fails to Operate | Fuse open - replace. If second fuse opens - look for cause of overload, shorted wiring, components, etc. |
| B+1 Off Value or Excessive Ripple | Check R4, C1, CR1, and CR2. |
| B+2 Off Value or Excessive Ripple | Check R1 for proper adjustment. Check R15, it will burn out if B+2 is overloaded. Check V1, V2, V3, tubes and circuitry. |
| B+3 Off Value or Excessive Ripple | Check R17 and R21 (these resistors adjust the voltage on the grid of V4, a cathode follower, which in turn determines the voltage on the cathode). Check R18 (this resistor will burn out if B+3 is overloaded). Check V4 and C2. |
| B-Off Value or Excessive Ripple | Check C3, C4, C5, CR3, R3, R5, and R6. Check V1 to see if it is lit properly (should be a steady orange glow). |
| V1 Not Lit Properly | If replacing V1 and checking the above parts does not remedy the trouble, check the line voltage. Low line voltage could cause this trouble. Reducing the value of R3 slightly will usually eliminate this difficulty. |

*Wire colors do not apply to shielded wires - single wires only.

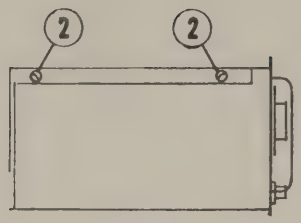
| | |
|---|---|
| R.F. Output is Low or Zero | Check R313 - this resistor will burn out if the B+ to the sweep oscillator is overloaded.<br><br>Check B+ to the sweep oscillator, cathode of V304. It should be a positive square wave of 25-100 volts and should vary as the OUTPUT LEVEL control varies.<br><br>If it is normal, look for RF difficulties, defective tube, components, shorted or open wiring, etc.<br><br>If the voltage is low and does not respond to the LEVEL control, remove first V303 and then V201. When either of these tubes conducts, the voltage on the grid of V304 (pin 2) is reduced and thus decreases the B+ to the sweep oscillator. If removal of V201 allows the B+ on V304 (pin 3) to return to normal, check the blanking tube, controls, and associated circuitry. If removal of V303 causes the B+ to return to normal, check the LEVELER controls, V301 and V302, tubes, and associated circuitry. |
| Poor Leveling | Replace monitor diodes. Also replace V301, V302, and V303. V301 is the most critical since it is in the first stage of the D.C. coupled amplifier. Resetting the printed circuit LEVEL controls is sometimes necessary if these tubes are replaced. |
| Weak Markers | Replace 1N82 or 1N34 crystal diode mixer. Check Birdy-By-Pass Amplifier, tubes and circuitry. |
| No Horizontal Output | Look for difficulty in the sawtooth circuitry V101. |
| Insufficient Sweep Width | Check adjustment of CENTERING and LINEARITY controls. (See Page 7). |
| Poor Display Linearity | Check diodes CR101, 102, and 103. Check LINEARITY controls. (See Page 7). |
| Sweep Dial Off Calibration | Check adjustment of CENTERING control. (See Page 7). Replace sweep oscillator tube V801. |

## CONVERSION FOR 230 VOLT POWER LINES

The dual primary of the power transformer is normally wired in parallel for use on 115 volt AC lines. If desired, the windings can easily be reconnected in series for use with 230 volt power. With the aid of the Chassis Layout, bottom view, locate terminals 1, 2, 3, and 4. Remove the jumper wires between terminals 1 and 2 and between terminals 3 and 4. Then install a jumper wire between terminals 2 and 3.

## RACK MOUNTED UNIT

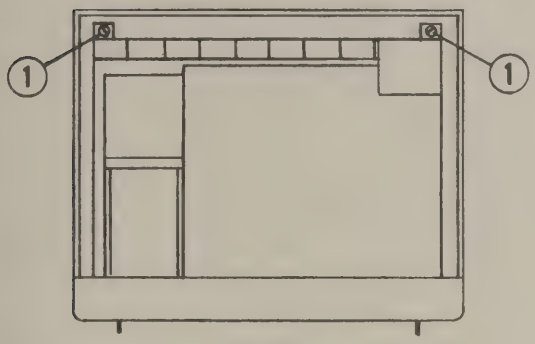
FRONT



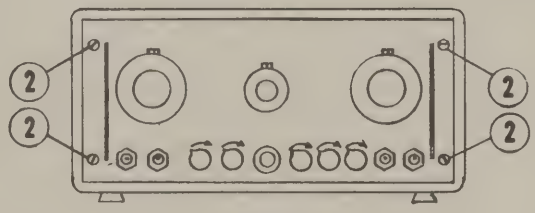

SIDE

Unit has front panel slotted or drilled for standard RTMA Mounting. Position unit in rack and install mounting screws in holes marked 1.
Dust cover removal: Remove four #8-32 thread-cutting screws, marked 2 (two on each side) and lift off cover for easy access to chassis.

## CABINET MOUNTED UNIT




TOP




FRONT

To remove chassis from cabinet; first remove the two #8-32 screws (marked 1 on top view above) at the back of the chassis (one on each side). These screws fasten the chassis to the cabinet guide rails. Second, remove the four #10-32 screws (marked 2 in front view above). The screws hold the panel to the cabinet.

Slide chassis out of cabinet by pulling forward on the two front panel handles.

To replace chassis in cabinet, insert the flanges on the bottom of the chassis side panels into the slot of the cabinet guide rails. Push chassis back into cabinet far enough for the slots in the side panel flanges to align with the retained nut in guide rail. Install the two #8-32 screws and tighten securely. Replace the four #10-32 screws in the front panel.

# PART VALUE INFORMATION

| SCHEMATIC PART DESIGNATION | |
|---|---|
| C | Capacitor |
| CR | Crystal Rectifier, Germanium Diode |
| F | Fuse |
| I | Incandescent Pilot Light |
| J | Jack or termination, Coaxial Connector |
| K | Cable |
| L | Coil |
| M | Meter or Motor |
| P | Plug, Coaxial Connector |
| R | Resistor, Fixed or Variable |
| S | Switch |
| T | Transformer |
| V | Tube |
| Z | Miscellaneous |

| SCHEMATIC VALUE ABBREVIATION | |
|---|---|
| Ω | ohms |
| K Ω | 1,000 ohms |
| M Ω | 1,000,000 ohms (megohms) |
| µf, uf | Microfarad |
| µµf, uuf | Micromicrofarad |
| µh, uh | Microhenry |
| mh | Millihenry |

RESISTORS - All resistors are 1/2 watt ± 10%, and are shown in ohms, unless otherwise specified.

NOTE: Resistors in the attenuator pads are ± 2%.

CAPACITORS - All Capacitors are shown in micromicrofarads (µµf) unless otherwise specified.

COILS - All coils are shown in microhenries (µh) unless otherwise specified.

PARTS LOCATION - F.P. Front Panel
P.C.B. Printed Circuit Board
R.P. Rear Panel
C.H. Chassis
T.P. Test Point

PARTS NUMBERS - LOCATION INFORMATION

1 - 99 - Power Supply
101 - 199 - Horizontal and Alternate Sweep Drive Circuit
201 - 299 - Blanking
301 - 399 - Leveler
401 - 499 - Birdy-By-Pass
501 - 599 - Mixer & Plug-In Markers
601 - 699 - Variable Markers
701 - 799 - Attenuators
801 - 899 - Sweep Oscillator and Sweep Drive Circuit
901 - 999 - Modifications and Special Circuits

*Indicates value of component adjusted at factory, and may deviate from value shown on print.

Indicates printed circuit board terminal.

N O T I C E

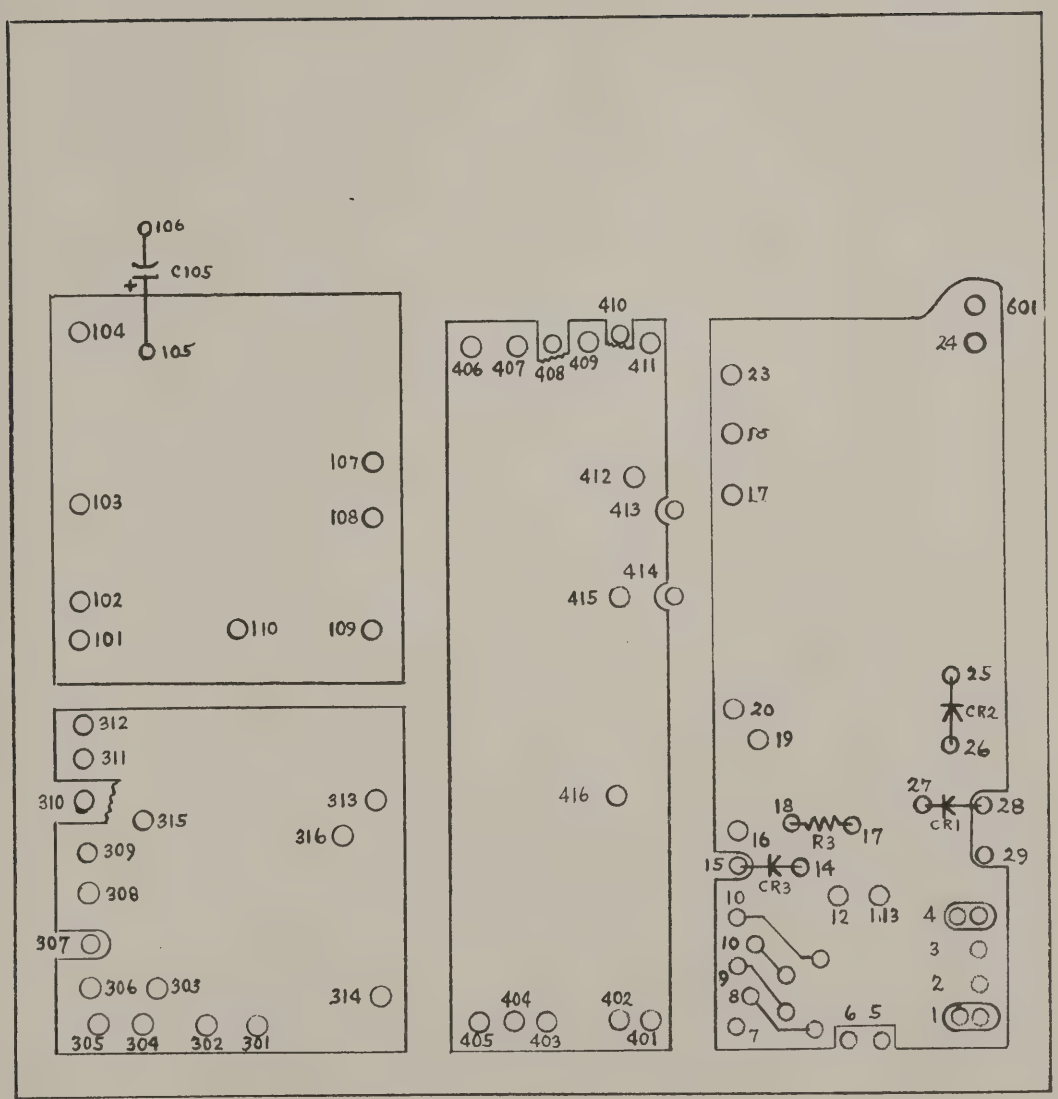
RED LACQUER IS USED TO INDICATE FASTENINGS THAT SHOULD NOT BE DISTURBED FOR ORDINARY SERVICE, AND TO SECURE ADJUSTABLE CONTROLS.

# CHASSIS LAYOUT

BOTTOM VIEW

TERMINALS

FRONT



V101 12AX7

V102 EL84/ 6BQ5

HORIZONTAL AND SWEEP DRIVE

V301 6AU6 | V302 12AX7 | V303 6AU6 | V201 12AX7

V304 EL84/ 6BQ5

LEVELER

BLANKING

POWER SUPPLY

V4 EL84/ 6BQ5

V3 EL84/ 6BQ5

V2 6AU6

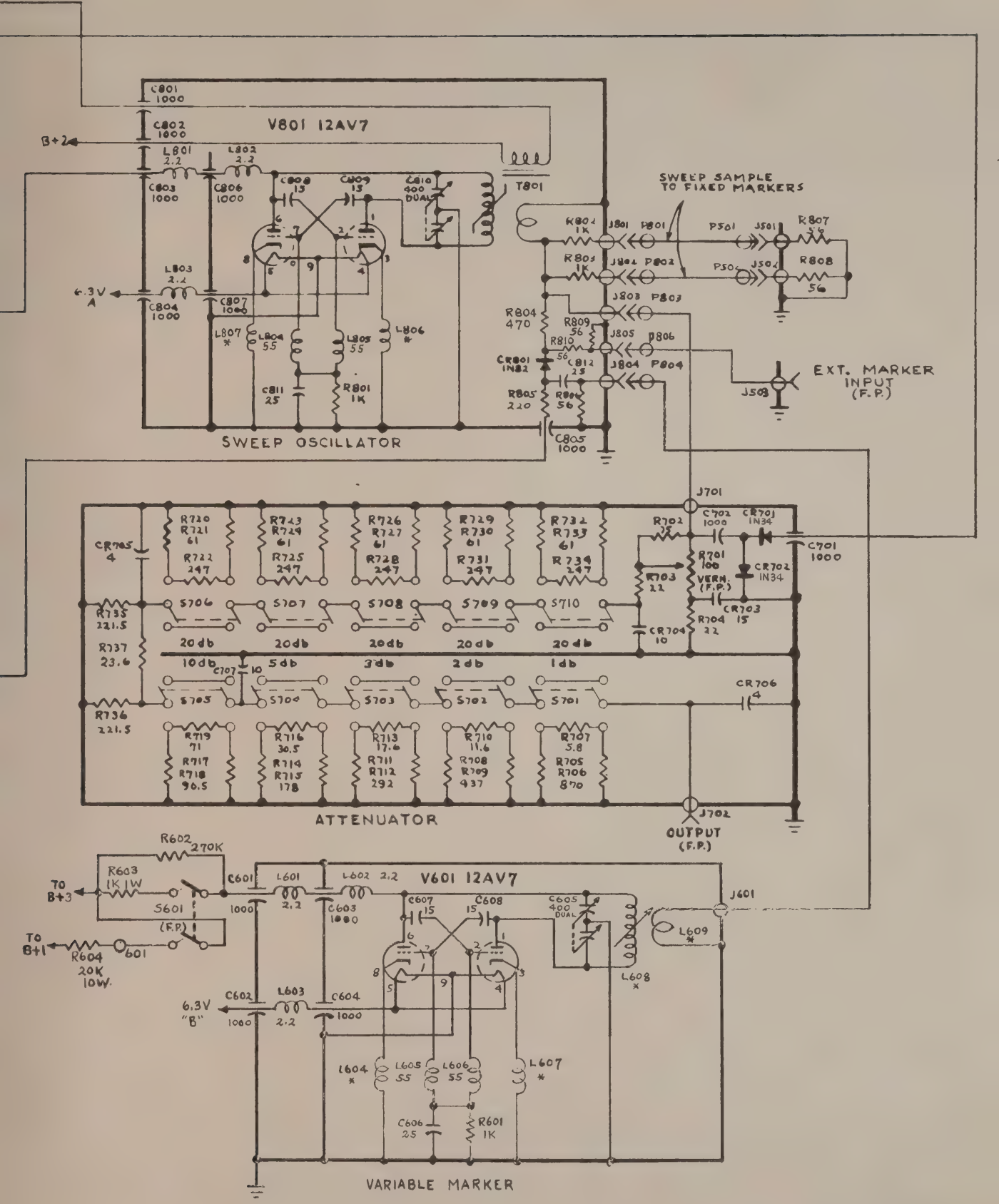
V1 5651

V404 12AX7 | V401 12AX7 | V402 12AX7 | V403 12AX7

FIXED MARKER PLUG-IN BASE

V3 | V4 | V304 | V2 | V101 | V102 | V201 | V301 | V302 | V303 | V401 | V402 | V403 | V404

742




# SWEEPER

## L5 M



Telonic INDUSTRIES, INC.
BEECH GROVE, INDIANA

# CDH-0.5 and CDH-1.0

## SPECIFICATIONS

Marker Accuracy ..... ±0.005%

Frequency Range
CDH-0.5 ..... 0.5-1000 MC
CDH-1.0 ..... 1.0-1000 MC

Marker Width
The width of the markers depends on the marker amplifier circuitry in the sweep generator and is adjustable at the MARKER SHAPER Control on the front panel of most instruments.

Marker Amplitude and Signal to Noise Ratio
The amplitude and signal to noise ratio of the markers also depend on the sweep generator. With a typical Telonic Sweep Generator, a clear marker will be produced by these units over the entire specified frequency range. A clear marker is considered to be one with at least 0.2V peak to peak amplitude and a signal to noise ratio of at least 10 to 1.

Voltage Requirements
B+ ..... 100V at 15 ma.
Filaments ..... 6.3V at 750 ma.
(Provided on all Telonic Sweep Generators)

Physical Size ..... 3¼" x 1½" x 2¾"
(Less tube, shield, and crystal)

Weight ..... 12 oz.
(Including tube, shield, and crystal)

## GENERAL DESCRIPTION

The Telonic CDH Markers produce crystal-controlled birdy-type markers at the fundamental and all harmonic frequencies to 1000 MC. These plug-in units are designed for use with Telonic Sweep Generators. The fundamental marker frequency, in megacycles, can be identified by the numerals following the letters CDH.

These units consist of a crystal oscillator, a harmonic generator, a mixer, and a video amplifier all contained in one "plug-in" unit occupying two marker sockets on the Telonic Sweep Generators. The oscillator is an electron-coupled Pierce circuit with the screen grid of the 6U8 acting as oscillator plate. The output from the oscillator is fed to a two-stage harmonic generator and then to a crystal diode mixer where it is combined with a signal from the sweep oscillator. The resultant heterodyne signals or beats are then amplified in a video amplifier and fed through a low-pass filter to the Birdy-By-Pass Amplifier in the Sweep Generator.

The crystals used are manufactured specifically for the associated oscillator circuitry, making proper allowance for capacitance of the crystal holders and other inherent reactive properties of the oscillator section.

The dual diode mixer circuit is engineered for harmonics of nearly constant amplitude over the entire range. High order harmonics sufficiently strong for a clear marker up to 1000 mc are available from all these units.

## MAINTENANCE

Maintenance of the CDH Harmonic Generators will normally be limited to replacement of component parts worn out in normal use or damaged by overload, accident, etc. Since there are no adjustable components used in this unit, the major cause of poor operation can usually be traced to a defective tube or diode.

Weak harmonic output and noise are symptoms usually indicating a defective diode. The replacement diode should have a high front to back resistance ratio if optimum results are to be realized.

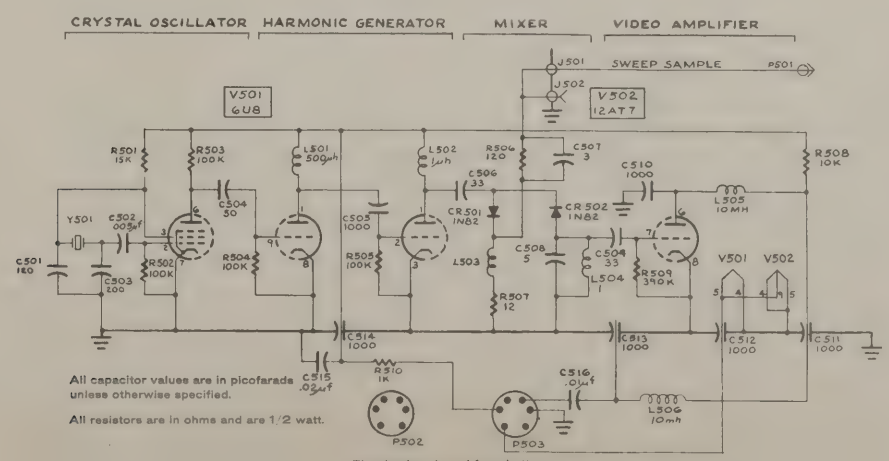
In the event replacement of a crystal is necessary, it is recommended that the replacement be ordered from Telonic Industries, Inc. Specified accuracy may not be realized with crystals from other sources.

To avoid electrical shock and damage to the diodes, do not remove or insert the marker unit or change any components without first turning off the unit.

## INSTALLATION

This plug-in unit can be inserted in any two of the eight plug-in sockets, built-in on all Telonic Sweep Generators, that will provide a connection for the sweep sample input and output connections. The sweep sample input (BNC jack) can be fed from either one of the two sweep sample lines in the unit or from the sweep sample output of an adjacent plug-in unit. The sweep sample output (BNC plug) should be connected to either one of the two BNC terminators on the chassis or the sweep sample input of an adjacent box, to provide a 50 ohm matched termination.

## SCHEMATIC



# PARTS LIST

for

CDH-0.5 and CDH-1.0

| CIRCUIT REF. | DESCRIPTION | TELONIC PART NO. |
|---|---|---|
| | **CAPACITORS** | |
| C501 | Fixed, ceramic, 120 pf, ±10%, 1000 VDCW | C-14 |
| C502 | Fixed, ceramic, 0.005 uf, GMV, 600 VDCW | C-49 |
| C503 | Fixed, ceramic, 200 pf, ±10%, 1000 VDCW | C-16 |
| C504 | Fixed, ceramic, 50 pf, ±10%, 1000 VDCW | C-11 |
| C505 | Fixed, ceramic, 1000 pf, GMV, 1000 VDCW | C-19 |
| C506 | Fixed, ceramic, 33 pf, ±10%, 1000 VDCW | C-10 |
| C507 | Fixed, composition, 3 pf, ±10%, 500 VDCW | C-34 |
| C508 | Fixed, ceramic, 5 pf, ±10%, 1000 VDCW | C-4 |
| C509 | Fixed, ceramic, 33 pf, ±10%, 1000 VDCW | C-10 |
| C510 | Fixed, ceramic, 1000 pf, GMV, 1000 VDCW | C-19 |
| C511 | Fixed, ceramic feedthru, 1000 pf, ±20%, 500 VDCW | C-39 |
| C512 | Fixed, ceramic feedthru, 1000 pf, ±20%, 500 VDCW | C-39 |
| C513 | Fixed, ceramic feedthru, 1000 pf, ±20%, 500 VDCW | C-39 |
| C514 | Fixed, ceramic feedthru, 1000 pf, ±20%, 500 VDCW | C-39 |
| C515 | Fixed, ceramic, 0.02 uf, +80-20%, 500 VDCW | C-21 |
| C516 | Fixed, ceramic, 0.01 uf, +80-20%, 500 VDCW | C-20 |
| | **SEMICONDUCTOR DEVICES** | |
| CR501 | Diode, 1N82 | D-1 |
| CR502 | Diode, 1N82 | D-1 |
| | **CONNECTORS, BNC** | |
| J501 | Terminator, cable, MX1684/U | J-9 |
| J502 | Receptable, jack, UG-625/U | J-7 |
| P501 | Plug, cable, UG-88B/U | J-32 |
| | **INDUCTORS** | |
| L501 | Fixed, 500 uh | L-109 |
| L502 | Fixed, 1 uh, ±15% | L-102 |
| L503 | Fixed, Strap | * |
| L504 | Fixed, 1 uh, ±15% | L-102 |
| L505 | Fixed, 10 mh | L-110 |
| L506 | Fixed, 10 mh | L-110 |

| CIRCUIT REF. | DESCRIPTION | TELONIC PART NO. |
|---|---|---|
| | **RESISTORS** | |
| R501 | Fixed, composition, 15K ohms, ±10%, ½W | R-66 |
| R502 | Fixed, composition, 100K ohms, ±10%, ½W | R-28 |
| R503 | Fixed, composition, 100K ohms, ±10%, ½W | R-28 |
| R504 | Fixed, composition, 100K ohms, ±10%, ½W | R-28 |
| R505 | Fixed, composition, 100K ohms, ±10%, ½W | R-28 |
| R506 | Fixed, composition, 120 ohms, ±10%, ½W | R-16 |
| R507 | Fixed, composition, 12 ohms, ±10%, ½W | R-10 |
| R508 | Fixed, composition, 10K ohms, ±10%, ½W | R-23 |
| R509 | Fixed, composition, 390K ohms, ±10%, ½W | R-72 |
| R510 | Fixed, composition, 1K ohms, ±10%, ½W | R-18 |
| | **TUBES** | |
| V501 | Electronic: 6U8 | VT-8 |
| V502 | Electronic: 12AT7 | VT-10 |
| | **QUARTZ CRYSTAL** | |
| Y501 | 0.5 mc for Model CDH-0.5 | X-4-0.5 mc |
| | 1.0 mc for Model CDH-1.0 | X-4-1.0 mc |
| | **MISCELLANEOUS** | |
| | Clip, diode (2 required) | S-9 |
| P502 | Plug, wafer | S-12 |
| P503 | Plug, wafer | S-12 |
| | Shield, tube (2 required) | S-13 |
| | Socket, tube, 9-pin (2 required) | S-8 |
| | Socket, Quartz crystal | S-18 |
| | Socket (mating socket for P502 and P503) (2 required) (NOT SUPPLIED) | S-11 |

*No part number assigned.

**WARRANTY**

**Products manufactured by Telonic Industries, Inc., are guaranteed against defective materials and workmanship for a period of one year, (except semi-conductors and vacuum tubes). This warranty does not apply to instruments that have been altered, improperly handled or damaged in any way beyond our control.**

# INSTRUCTION MANUAL
# for
# TELONIC MODELS
# CDH-2 thru CDH-12.5

## SPECIFICATIONS

Crystal Accuracy.....±0.005%

Frequency Range

CDH-2 to CDH-5.....2-1000 mc

CDH-5 to CDH-12.5.....5-1200 mc

Marker Width.....100-400 kc

(Adjustable by Sweep Generator Marker Shaper Control)

Marker Amplitude

(Adjustable at Marker Size Control on Sweep Generator)

CDH-2 to CDH-5.....Over 0.1V peak to peak at 1000 mc

CDH-5 to CDH-12.5.....Over 0.1V peak to peak at 1200 mc

Voltage Requirements...B+ 105V regulated dc
Filaments 6.3V ac

## GENERAL DESCRIPTION

The Telonic CDH Markers are crystal-controlled plug-in harmonic units for use with Telonic Sweep Generators. The marker frequency can be identified by the numerals following the letters CDH.

These units consist of a Pierce Crystal Oscillator, a harmonic generator, a mixer, and a video amplifier all contained in one "plug-in" unit occupying two marker sockets on the Telonic Sweep Generators. The output from the oscillator is fed to a two-stage harmonic generator and then to a crystal diode mixer where it is combined with a signal from the sweep oscillator. The resultant heterodyne signals or beats are then amplified in a video amplifier and fed through a low-pass filter to the Birdy-By-Pass Amplifier in the Sweep Generator.

The crystals used are manufactured specifically for the associated oscillator circuitry, making proper allowance for capacitance of the crystal holders and other inherent reactive properties of the oscillator section.

The dual diode mixer circuit is engineered for harmonics of nearly constant amplitude over the entire range. High order harmonics sufficiently strong for a clear marker up to 1000 mc are available from all these units. The CDH-5 through CDH-12.5 will mark firmly to 1200 mc.

## MAINTENANCE

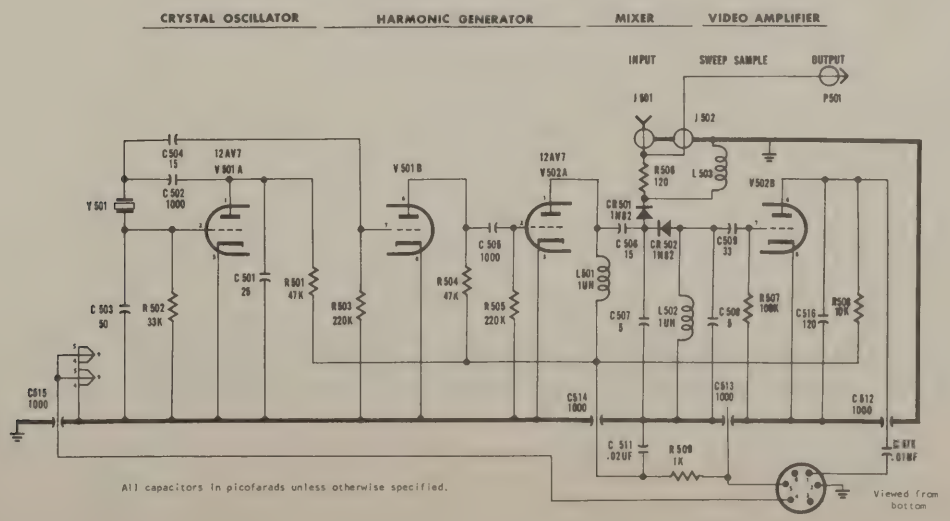
Maintenance of the CDH Harmonic Generators will normally be limited to replacement of component parts worn out in normal use or damaged by overload, accident, etc. Since there are no adjustable components used in this unit, the major cause of poor operation can usually be traced to a defective tube or diode.

Weak harmonic output and noise are symptoms usually indicating a defective diode. The replacement diode should have a high front to back resistance ratio if optimum results are to be realized.

## INSTALLATION

This plug-in unit can be inserted in any two of the eight plug-in sockets, built-in on all Telonic Sweep Generators, that will provide a connection for the sweep sample input and output connections. The sweep sample input (BNC jack) can be fed from either one of the two sweep sample lines in the unit or from the sweep sample output of an adjacent plug-in unit. The sweep sample output (BNC plug) should be connected to either one of the two BNC terminators on the chassis or the sweep sample input of an adjacent box, to provide a 50 ohm matched termination.

## SCHEMATIC



# REPLACEMENT PARTS LIST

for

CDH-2 thru CDH-12.5

| CIRCUIT REF. | DESCRIPTION | TELONIC PART NO. |
|---|---|---|
| | **CAPACITORS** | |
| C501 | Fixed, ceramic dielectric, 25uuf, NPO, ±10%, 1000VDCW | C9 |
| C502 | Fixed, ceramic dielectric, 1000uuf, GMV, 1000VDCW | C19 |
| C503 | Fixed, ceramic dielectric, 50uuf, NPO, ±10%, 1000VDCW | C11 |
| C504 | Fixed, ceramic dielectric, 15uuf, NPO, ±10%, 1000VDCW | C7 |
| C505 | Fixed, ceramic dielectric, 1000uuf, GMV, 1000VDCW | C19 |
| C506 | Fixed, ceramic dielectric, 15uuf, NPO, ±10%, 1000VDCW | C7 |
| C507 | Fixed, ceramic dielectric, 5uuf, NPO, ±10%, 1000VDCW | C4 |
| C508 | Fixed, ceramic dielectric, 5uuf, NPO, ±10%, 1000VDCW | C4 |
| C509 | Fixed, ceramic dielectric, 33uuf, NPO, ±10%, 1000VDCW | C10 |
| C510 | Fixed, ceramic dielectric, .01uf, +80-20%, 500VDCW | C20 |
| C511 | Fixed, ceramic dielectric, .02uf, +80-20%, 500VDCW | C21 |
| C512 | Fixed, ceramic feedthru, 1000uuf, ±20%, 500VDCW | C39 |
| C513 | Fixed, ceramic feedthru, 1000uuf, ±20%, 500VDCW | C39 |
| C514 | Fixed, ceramic feedthru, 1000uuf, ±20%, 500VDCW | C39 |
| C515 | Fixed, ceramic feedthru, 1000uuf, ±20%, 500VDCW | C39 |
| C516 | Fixed, ceramic dielectric, 120uuf, N750, ±10%, 1000VDCW | C14 |
| | **SEMICONDUCTORS** | |
| CR501 | Diode, 1N82 | D1 |
| CR502 | Diode, 1N82 | D1 |

| CIRCUIT REF. | DESCRIPTION | TELONIC PART NO. |
|---|---|---|
| | **BNC CONNECTORS** | |
| J501 | Receptacle, electrical, UG[illegible]/U | J7 |
| J502 | Terminator, cable, MX1684/U | J9 |
| P501 | Plug, electrical, UG88/U | J1 |
| | **INDUCTORS** | |
| L501 | Coil, radio frequency, 1uh | L102 |
| L502 | Coil, radio frequency, 1uh | L102 |
| L503 | Coil, radio frequency | * |
| | **RESISTORS** | |
| R501 | Fixed, composition, 47Kohm, ±10%, 1/2W | R27 |
| R502 | Fixed, composition, 33Kohm, ±10%, 1/2W | R36 |
| R503 | Fixed, composition, 220Kohm, ±10%, 1/2W | R44 |
| R504 | Fixed, composition, 47Kohm, ±10%, 1/2W | R27 |
| R505 | Fixed, composition, 220Kohm, ±10%, 1/2W | R44 |
| R506 | Fixed, composition, 120 ohm, ±10%, 1/2W | R16 |
| R507 | Fixed, composition, 100Kohm, ±10%, 1/2W | R28 |
| R508 | Fixed, composition, 10Kohm, ±10%, 1/2W | R23 |
| R509 | Fixed, composition, 1Kohm, ±10%, 1/2W | R18 |
| | **TUBES** | |
| V501 | Electronic: 12AV7 | VT12 |
| V502 | Electronic: 12AV7 | VT12 |
| | **QUARTZ CRYSTAL** | |
| Y501 | Fundamental operation, parallel resonant circuit, 2 thru 12.5 mc (depends on Model Number) | |
| | **MISCELLANEOUS** | |
| | Plug, wafer (2 required) | S12 |
| | Shield, tube (2 required) | S13 |
| | Socket, tube, 9-pin (2 required) | S8 |
| | Socket, crystal | S18 |
| | Clip, diode (2 required) | S9 |

* No part number assigned.

## WARRANTY

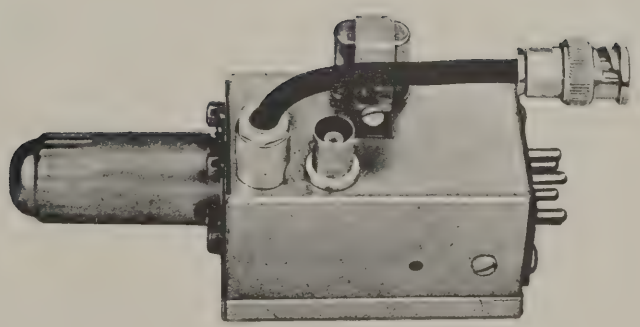
Products manufactured by Telonic Industries are guaranteed against defective material and workmanship for a period of one year from date of purchase (except electron tubes and semiconductors). This warranty does not apply to instruments that have been altered, improperly handled or damaged in any way beyond our control.

# MANUAL

Telonic®

## PLUG-IN MARKER

## TYPE C





Telonic INDUSTRIES, INC. BEECH GROVE, INDIANA

# PLUG-IN MARKER
# TYPE C

| MARKER FREQUENCY MC | XTAL FREQUENCY MC |
|---|---|
| 55 | 27.5 |
| 60 | 30.0 |
| 65 | 32.5 |
| | |
| | |
| | |
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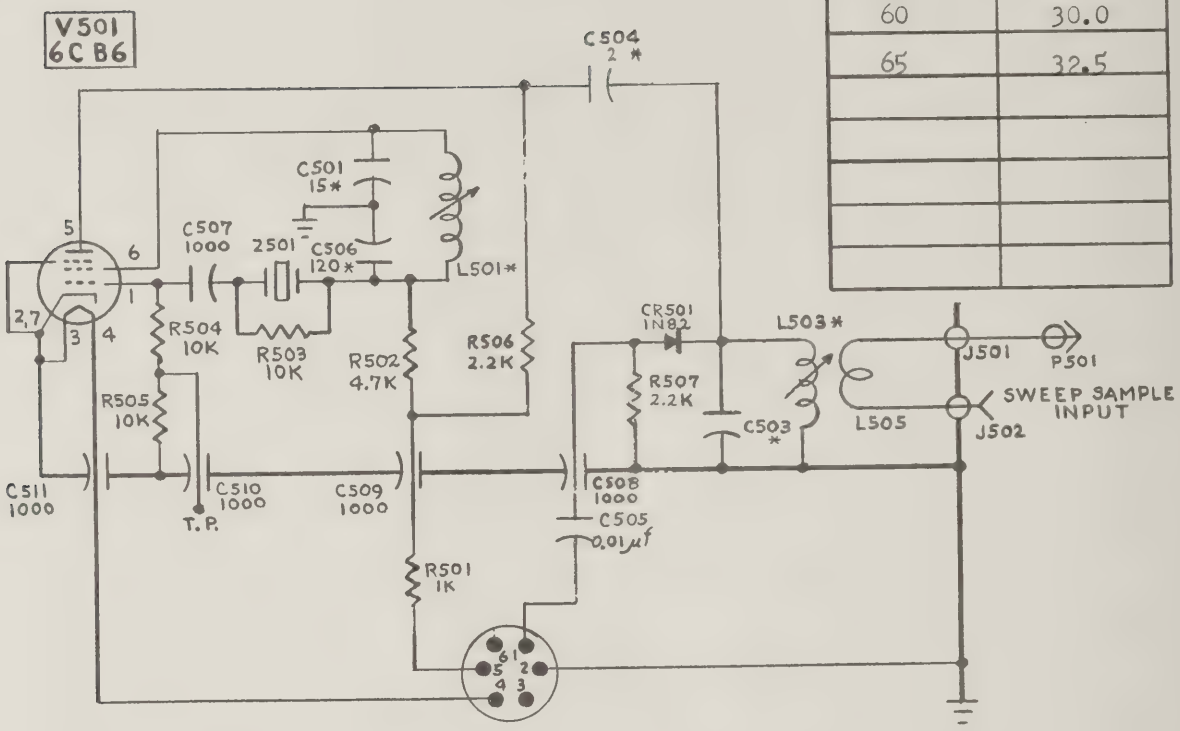



GENERAL DESCRIPTION: These units contain an overtone crystal oscillator comprised of the screen grid, control grid, and cathode circuit of the 6CB6 tube. Since the oscillator operates Class C, the plate current consists of sharp pulses which result in a signal rich in harmonics. This signal is coupled by C504 to a tank circuit (L503 and C503)tuned to the frequency of the desired marker. A sample of the sweep signal is also coupled into this tank circuit by L505. These two signals are then mixed in a crystal diode mixer, CR501. The resultant birdy is fed into the Birdy-By-Pass Amplifier, superimposed upon the demodulated swept signal and applied to the Vertical Amplifier of the oscilloscope.

ADJUSTMENT PROCEDURE: A test point is provided for easy adjustment of the crystal oscillator. L501 is adjusted for near maximum negative voltage at this test point. This is usually in the order of 1 to 5 volts. This adjustment should be made slightly off the peak on the low inductance side since the effects of tuning are critical on the other side of the resonant curve. L503 is adjusted for maximum marker amplitude and minimum spurious marker signals. Marker size can be varied by adjusting the coupling between L505 and L503. Spurious markers at multiples of the crystal oscillator frequency and a weak marker at the desired frequency will result if CR501 has a low front to back ratio. The ratio of desired to spurious markers will normally be over 10 to 1.

## PARTS LIST FOR MARKER BOX

| CIRCUIT REF. | DESCRIPTION | PART NO. |
|---|---|---|
| C501* | Capacitor: fixed, ceramic, disc, 15 uuf., ±10%, NPO, 1000 vdcw | C-7 |
| C502* | This circuit reference not assigned. | |
| C503* | Capacitor: fixed, ceramic, disc, ±10%, NPO, 1000 vdcw | |
| C504* | Capacitor: fixed, composition, 2 uuf., ±10%, 500 vdcw | C-33 |
| C505 | Capacitor: fixed, ceramic, disc, 2 uuf., GMV, 600 vdcw | C-20 |
| C506* | Capacitor: fixed, ceramic, disc, 120 uuf., ±10%, N750, 1000 vdcw | C-14 |
| C507 | Capacitor: fixed, ceramic, disc, 1000 uuf., GMV, 600 vdcw | C-19 |
| C508 | Capacitor: fixed, ceramic, feed thru, 1000 uuf., GMV, 500 vdcw | C-39 |
| C509 | Capacitor: fixed, ceramic, feed thru, 1000 uuf., GMV, 500 vdcw | C-39 |
| C510 | Capacitor: fixed, ceramic, feed thru, 1000 uuf., GMV, 500 vdcw | C-39 |
| C511 | Capacitor: fixed, ceramic, feed thru, 1000 uuf., GMV, 500 vdcw | C-39 |
| CR501 | Rectifier: crystal diode, 1N82 | D-1 |
| J501 | BNC Termination: cable MX1684/U | J-9 |
| J502 | BNC Jack: Receptacle, single hole mounted UG625/U | J-7 |
| P501 | BNC Plug: cable UG88/U | J-1 |
| L501* | Coil: adjustable | |
| L502* | This circuit reference not assigned. | |
| L503* | Coil: adjustable | |
| L504 | This circuit reference not assigned | |
| L505* | Coil: fixed, coupling loop | |
| R501 | Resistor: fixed, composition, 1KΩ, ±10%, 1/2W | R-18 |
| R502 | Resistor: fixed, composition, 4.7K ohms, ±10%, ½W | R-21 |
| R503 | Resistor: fixed, composition, 10K ohms, ±10%, ½W | R-23 |
| R504 | Resistor: fixed, composition, 10K ohms, ±10%, ½W | R-23 |
| R505 | Resistor: fixed, composition, 10K ohms, ±10%, ½W | R-23 |
| R506 | Resistor: fixed, composition, 2.2K ohms, ±10%, ½W | R-20 |
| R507 | Resistor: fixed, composition, 2.2K ohms, ±10%, ½W | R-20 |
| V501 | Tube: electronic: 6CB6 | VT-6 |
| Z501* | Crystal: Quartz, overtone, series operation, .005% | |
| | Plug: marker | S-12 |
| | Shield: tube | S-14 |
| | Socket: 7 pin mica filled | S-7 |
| | Socket: Quartz Crystal | S-18 |
| | Socket: crystal diode | S-9 |

*These values subject to change depending upon the specific marker frequencies.

## TELONIC INSTRUMENTS AND ACCESSORIES

Products manufactured by TELONIC INDUSTRIES, INC. are guaranteed against defective materials and workmanship for a period of one year (vacuum tubes and semiconductors excepted) from date of purchase. This warranty does not apply to instruments that have been altered, improperly handled or damaged in any way beyond our control.

Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

## CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications, without incurring any liability to modify equipment previously sold.

## RETURNING EQUIPMENT TO FACTORY

Factory service is available for repair and readjustment of this instrument. However, a description of the trouble should be forwarded FIRST, whereupon instructions for correcting the trouble OR authorization for returning the equipment will be given. This applies to all units, whether under warranty or not.

Telonic®

# SWEEP GENERATORS

CATALOG S-C

for precise measurement of frequency response . . .

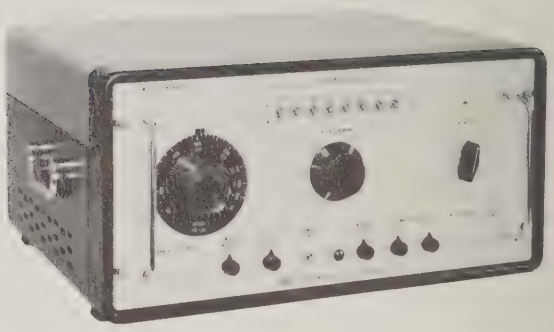
. in the laboratory

. . . on the production line

- *Sweep Generators*
- *Marker Equipment*
- *RF Attenuators*
- *RF Detectors*
- *RF Filters*

Telonic INDUSTRIES, INC. BEECH GROVE, INDIANA

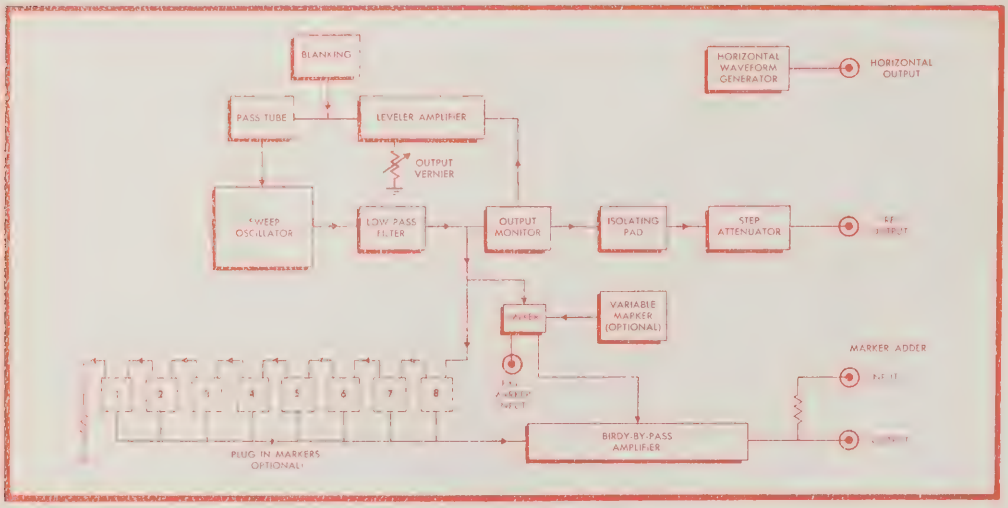
# Telonic SWEEP GENERATORS



The ultimate check on RF circuit quality is frequency response. Telonic Sweep Generators permit accurate, rapid measurements of frequency response under both laboratory and production-line conditions.

A Telonic Sweep Generator scans the entire frequency range in a 60th of a second, replacing the tedious point-to-point testing normally required. At the same time, the amplitude of the swept signal is precisely controlled to produce a constant voltage input to the circuit under test.

The circuit output is normally demodulated and presented as a continuous oscilloscope trace. Precision attenuators allow quantitative measurements of the results. Internal and external markers provide automatic frequency calibration. Telonic Sweep Generators may be used to perform rapid frequency-response tests on filters, mixers, amplifiers, and a wide variety of other RF circuits.



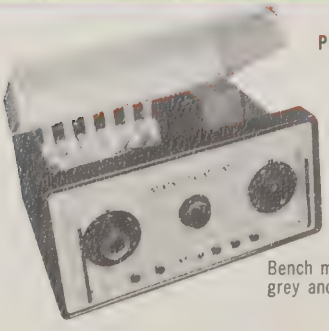

BLOCK DIAGRAM FOR TYPICAL TELONIC SWEEP GENERATOR

## ACCURATE MEASUREMENTS

The heart of every Telonic Sweep Generator is a vacuum-tube oscillator. The frequency of this oscillator is swept through the desired range by a modulator consisting of either a saturated ferrite core or a precision vibrating capacitor. A sawtooth voltage is provided for connection to the horizontal input of the oscilloscope. This waveform is in phase with the swept signal and provides the "X" axis value of the instantaneous amplitude versus frequency graph appearing on the oscilloscope. The oscillator is cut-off during the return sweep providing a flat base line on the oscilloscope for quantitative measurements.

In point-to-point frequency response determinations, the power of a standard type signal generator must be adjusted each time a new frequency is selected. A Telonic Sweep Generator makes this adjustment automatically and continuously. An electronic regulator maintains the power output of the oscillator circuit at a constant level.

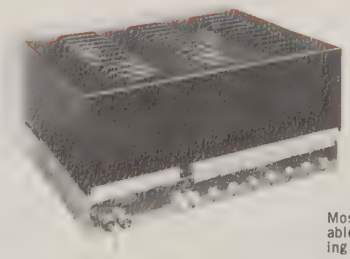
Accurate toggle switch or turret attenuators reduce the power input to the circuit under test by precisely known amounts. These attenuators have been especially designed for flat frequency response across the range being measured. Frequency markers are superimposed on the signal trace (see last page) *after* it has passed through the circuit under test and has been detected, preventing any distortion in the amplitude measurement.



**PHYSICAL DESCRIPTION**

Panel — ⅛" x 8¾" x 19"
Chassis — 2" x 14½" x 17"

Bench models are enclosed in a hinged top grey and black satin cabinet.



For rack mounting, bench models are enclosed by dust covers and finished in flat black enamel.

Most bench models are also available in portable cabinets. Provisions are included for adding up to eight plug-in markers.

## GENERAL SPECIFICATIONS (Generally applicable to Telonic Sweep Generators)

Flatness.....±5% over maximum sweep width
Zero Base Line.....Oscillator off during return sweep
Sweep Rate.....Line frequency (50-60 cps)
Horizontal Sweep.....Approximately 15 volts
Vernier Attenuation.....0-10 db.

Power.....115 v. 50/60 cycle, approx. 120 watts
Display Linearity.....Better than 1.2:1
Radiation.....Less than 10 microvolts
Source VSWR.....Below 1.3:1
Markers.....Birdy-By-Pass Marker System

Variable Markers.....Available on HD-3, 4 and 7, LD, LR, SD & ED Models

| Model | Center Frequency | Sweep Width | Range | Attenuation (db) (T) Turret (S) Toggle Switch | Output (into 50 ohms) | Remarks | Bulletin Number |
|---|---|---|---|---|---|---|---|
| HD-1A | .5-400 mc<br>390-900 mc | 200kc-200 mc<br>.06-10% | .5-910 mc | T-0, 10, 20, 30, 40, 50 | .75V, p to p<br>1.5V, p to p | Lo band heterodyne<br>Hi band fundamental | T-209 |
| HD-3 | .5-200 mc | 200kc-200 mc | .5-300 mc | T-0, 10, 20, 30, 40, 50 | .75V, p to p | Heterodyne type—wide sweep width and tunable center frequencies | T-210 |
| HD-4 | 10kc-10 mc | 25kc-10 mc | 10kc-15 mc | S-20, 20, 20, 10, 6, 3 | 1V, p to p | Video sweep—wide or narrow | T-213 |
| HD-7 | 100kc-75 mc | 100kc-50 mc | 100kc-100 mc | S-20, 20, 20, 10, 6, 3 | 1V, p to p | Video and IF frequencies<br>Higher video and IF frequencies | |
| LD-3 | 4-15 mc | .05-40% of CF | 3.5-17.5 mc | S-20, 20, 20, 20, 20, 10, 5, 3, 2, 1 | 1uV-1V, RMS | Electronically swept • Fundamental frequency type • Wide range of output levels • Exceptionally stable, flat and free from spurious content | T-214 |
| LD-4 | 10-35 mc | .05-40% of CF | 9-40 mc | | | | |
| LD-5 | 20-75 mc | .05-40% of CF | 16-90 mc | | | | |
| LD-6 | 50-125 mc | .05-30% of CF | 45-140 mc | | | | |
| LR Series with plug-in sweeper heads | | | | S-20, 20, 20, 20, 20, 10, 5, 3, 2, 1 | 1uV-1V, RMS | Similar to LD Models, but includes variable sweep rate of .01 to 100 cps and other features. For testing narrow band devices, crystal filters, etc. | T-215 |
| PLR-3 | 4-15 mc | .05-40% of CF | 3.4-17.5 mc | | | Plug-in Sweep Oscillator Heads for use with the LR series Variable Rate Sweep Generators | |
| PLR-4 | 10-35 mc | .05-40% of CF | 9-40 mc | | | | |
| PLR-5 | 20-75 mc | .05-40% of CF | 16-90 mc | | | | |
| PLR-6 | 50-125 mc | .05-30% of CF | 45-140 mc | | | | |
| SD-2 | 215-450 mc | .03-15% of CF | 200-460 mc | T-0, 10, 20, 30, 40, 50 | 1V, RMS | Capacitive sweep<br>Center frequency tuning<br>Exceptionally flat VHF-UHF-low microwave applications | T-207 |
| SD-3 | 440-920 mc | .06-10% of CF | 425-930 mc | T-0, 10, 20, 30, 40, 50 | .75V, RMS | | |
| SD-4 | 930-1250 mc | .1-50 mc | 900-1260 mc | T-0, 10, 20, 30, 40, 50 | .75V, RMS | | |
| SD-200 | | 180 mc | 260-440 mc | T-0, 10, 20, 30, 40, 50 | 1V, RMS | Capacitive sweep<br>Fixed tuned<br>Exceptionally wide, flat sweep<br>Wide band applications<br>UHF and microwave | |
| SD-201 | | 175 mc | 325-500 mc | T-0, 10, 20, 30, 40, 50 | 1V, RMS | | |
| SD-202 | | 250 mc | 500-750 mc | T-0, 10, 20, 30, 40, 50 | 1V, RMS | | |
| SD-203 | | 300 mc | 650-950 mc | T-0, 10, 20, 30, 40, 50 | 1V, RMS | | |
| SD-204 | | 400 mc | 800-1200 mc | T-0, 10, 20, 30, 40, 50 | 1V, RMS | | |
| SD-205 | | 350 mc | 900-1250 mc | T-0, 10, 20, 30, 40, 50 | 1V, RMS | | |
| SD-206 | | 200 mc | 1200-1400 mc | T-0, 10, 20, 30, 40, 50 | 1V, RMS | | |
| ED-1A | 1000-1700 mc | .02-6% of CF | 975-1750 mc | Vernier 0-10 db | .3V, RMS | Output is the result of 2nd harmonic generation and filtering—and thus these ranges are obtained from the highly reliable SD type of oscillator | T-216 |
| ED-4A | 1350-2400 mc | .02-6% of CF | 1350-2450 mc | | | | |
| PD-1 | 5-50 mc | 0-20% | 4.2-53 mc | T-0 to 59 db in 1 db steps | 4 watts Sweep & Mod. CW, 2 watts Unmodulated CW | HI POWER SWEEP & CW Generator excellent for FILTER and RF transmission line and antenna testing. Functions include Sweep; Mod. sweep; CW & Mod. CW; Internal 1000 cps modulation | T-217 |
| PD-2 | 20-100 mc | 0-20% | 17-105 mc | | | | |
| PD-3 | 100-250 mc | 0-20% | 85-260 mc | | | | |
| PD-4 | 250-500 mc | 0-20% | 210-520 mc | | | | |
| PD-5 | 300-600 mc | 0-20% | 250-625 mc | | | | |
| PD-6 | 500-1000 mc | 0-15% | 450-1010 mc | | | | |

T-206A

SSX-2 Series — Available in ranges from 1 mc to over 100 mc. Similar to LD models but includes: CW, mod. CW, pulsed CW, variable marker and other features. Ideal for IF amplifier testing.

BULLETIN No. T-206A

T-208

302 and 303 Test Sets — Instruments now being used for testing missile and radar IF systems — engineering, production and included as ground support equipment.

BULLETIN No. T-208

T-203B

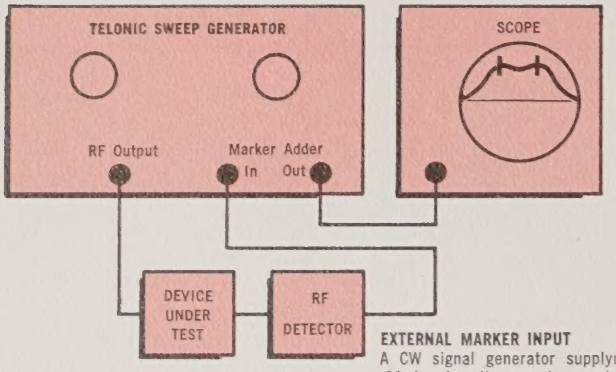
VHF and UHF TV Production Sweep Generators — Telonic Sweep Generators are used universally by almost every television manufacturer in the United States and overseas. Numerous models with unique features and special accessories are available.

BULLETIN No. T-203B

## BIRDY-BY-PASS MARKER SYSTEM

In this system, beat or birdy pips are produced by mixing a sample of the sweep oscillator signal with the marker output. The "birdies" are fed through an amplifier and are added to the demodulated sweep signal before it is connected to the scope vertical amplifier. The markers completely bypass the device under test.

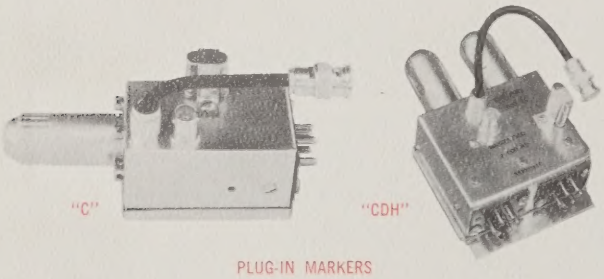
Since the markers are produced directly, no frequency error can occur other than in the marker oscillator itself. In addition to accuracy it features — stability, versatility and simplicity.




**EXTERNAL MARKER INPUT**
A CW signal generator supplying .01 to .1 volts may be used to produce a variable marker.

Eight plug-in sockets are included on the chassis of the HD, LD, SD, LR and ED Sweep Generators. Eight ON/OFF switches are also mounted on the front panel. This permits mounting up to eight of the "C" and "CH" type markers, up to four "CDH" type, or a combination of the plug-in types.

The "C" unit makes use of crystals up to 60 mc and generates a *single* marker by use of frequency selective circuits that combine the approximate harmonic with the swept signal sample in a diode mixer. Single markers can be produced to as high as 1250 mc.




PLUG-IN MARKERS

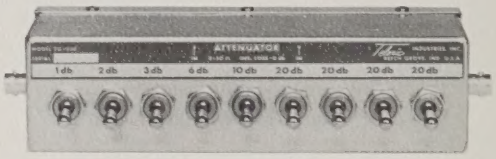
The selective circuits of the "C" unit are omitted in the "CH" units; thus a marker is produced at each harmonic of the crystal. The amplitude of the harmonics decrease therefore limiting the usefullness of the "CH" units to between the 10th or 15th harmonic.

The "CDH" circuit includes two dual triodes to greatly extend the range of harmonics. These units maintain a relatively constant level to as high as the 200th harmonic. Crystal frequencies of from 0.5 to 10 mc are normally used. Since an untuned type of oscillator circuit is used, frequency depends solely upon the crystal used.

BULLETIN No. T-218

## RF ATTENUATORS

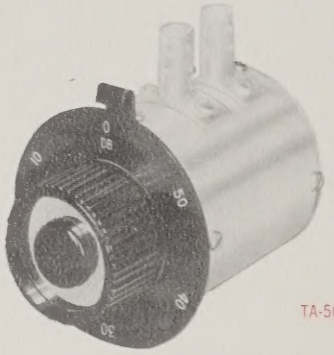
Telonic RF Attenuators are available in two forms: toggle switch and turret. The toggle switch type is recommended in the frequency range, 0-250 mc. Turret attenuators may be used to 1,250 mc. Connectors are BNC type.




TG-950 STEP ATTENUATOR

Toggle Switch Attenuators are supplied in standard models containing 6 or 9 steps, with 1.0 to 20 db of attenuation per step. Resistor accuracies are 1% and impedances of 50 or 75 ohms may be specified. A six-step unit measures 1⅞ x 1⅞ x 5⅛.

BULLETIN No. T-201B




TA-50 TURRET ATTENUATOR

THE TELONIC MODEL TA-50 TURRET ATTENUATOR is a highly accurate, six-position unit providing 0, 10, 20, 30, 40 and 50 db attenuation of RF signals from DC to 1250 mc.
Other Telonic Turret Attenuators are available that provide accurate attenuation in the 0-10 and 0-59 db ranges in 1 db steps, and tandem units of these configurations to operate two separate circuits simultaneously.

BULLETINS No. T-212A and T-227

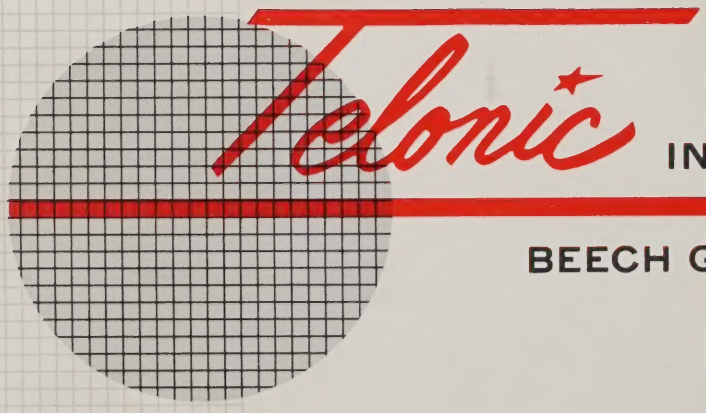
XD-3A RF DETECTOR

Telonic RF Detectors are used whenever the circuit under test lacks "built-in" demodulation or "look" points. The Telonic RF Detectors are available in a wide range of impedance values. The complete unit includes a termination resistance, an easily replaced crystal diode, and a low pass filter to remove RF from the DC output.

Model XD-3A is a 1-1250 mc detector generally recommended for use with the HD-1, HD-3 and SD Telonic Sweep Generators. Model XD-8 is recommended for use with the HD-4, HD-7 and LD Telonic Sweep Generators, and in all applications involving the frequency range 1-250 mc. Model XD-36 is recommended for the ED Series Sweep Generator and is designed for the range of 1000-2500 mc.

BULLETIN No. T-204A

Telonic INDUSTRIES, INC.
BEECH GROVE, INDIANA




INDUSTRIES INC.

BEECH GROVE, INDIANA